Environmental Consequences of Increased Use of Ethanol and Alkylates in California Fuels

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Framework for Comparative Evaluation of Environmental Impacts of Fuel Options

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NCEA
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“Compared to gasoline, the ethers MTBE and ETBE have relatively large aqueous solubilities and would likely leach more rapidly through soil and groundwater. Also, limited data suggest that ethers may be persistent in sub-surface environments.”

U.S. EPA (1992)

“Very little is known about emissions and releases from MTBE and ETBE storage and distribution, making this area an appropriate target for research.”

U.S. EPA (1992)

“Research Objectives:

1. Assess the impact of reformulated gasolines on the potential for groundwater contamination and resultant pollutant exposure.”

U.S. EPA (1992)

U.S. EPA (1992):

Alternative Fuels Research Strategy

US Environmental Protection Agency

Office of Research and Development

Report EPA/600/AP-92/002

www.epa.gov/ncea/pdfs/mtbe/altfuel.pdf

Risk Assessment

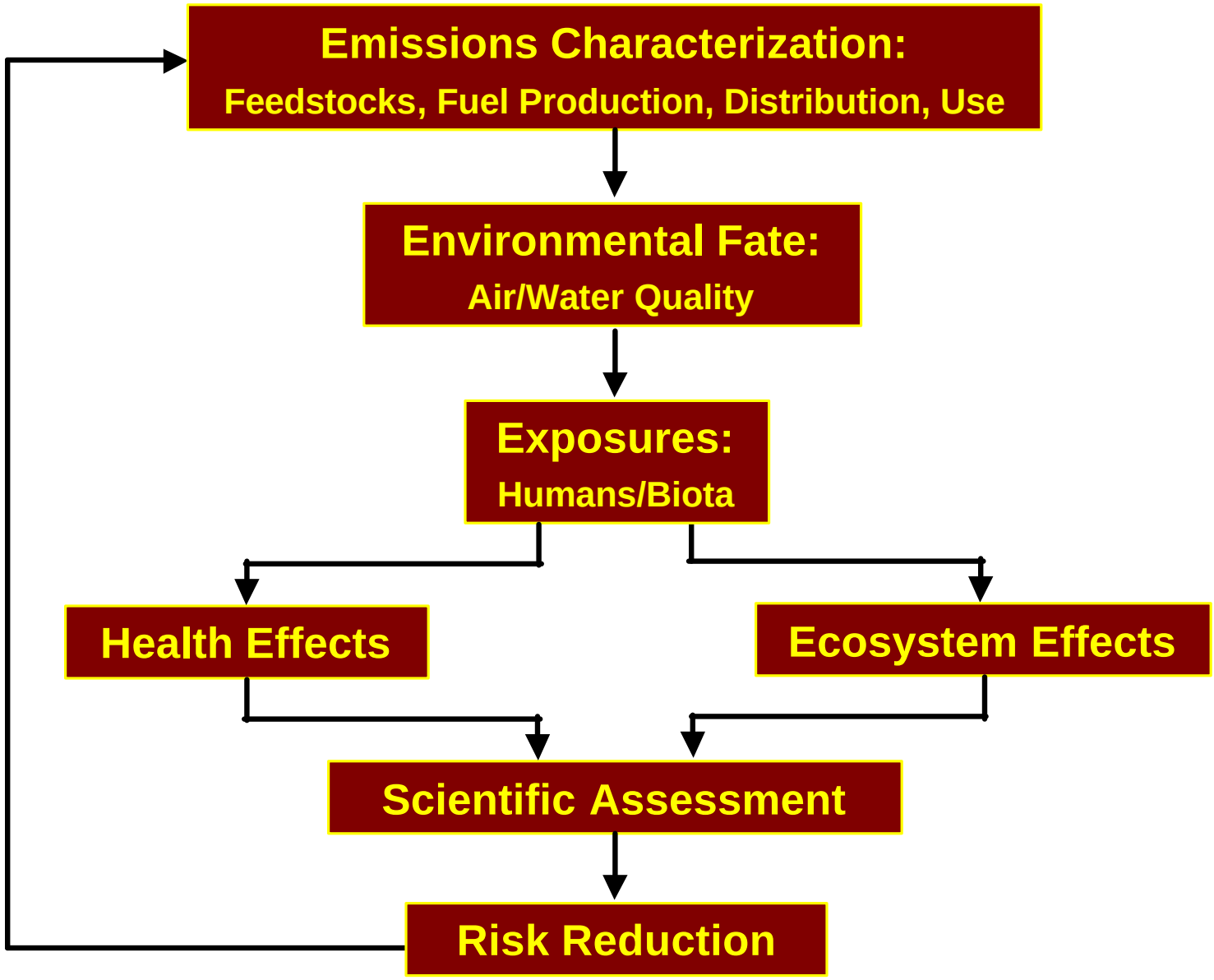
Hazard Identification
(Qualitative)

Dose-Response
(Quantitative)

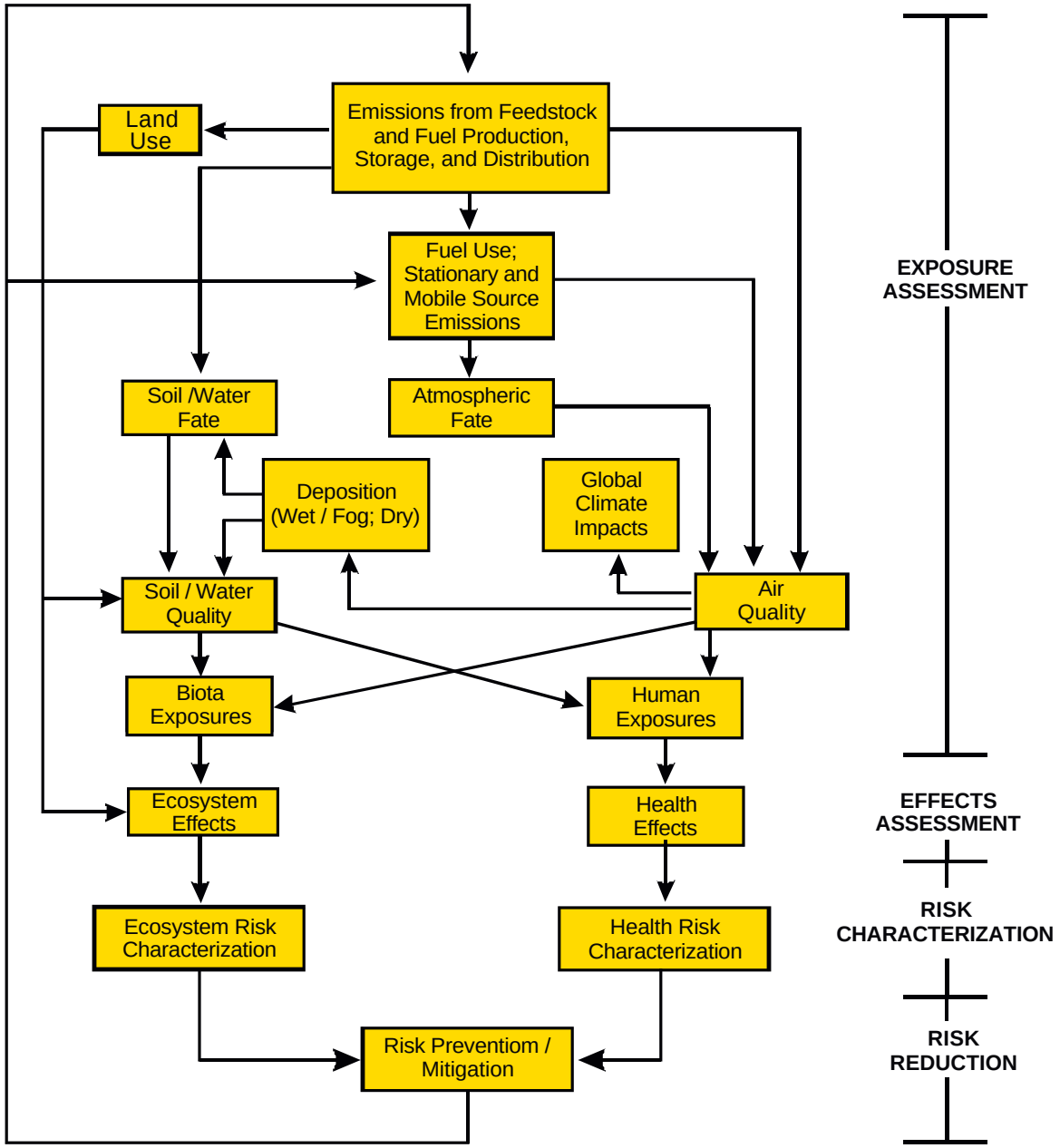
Exposure
(Population contact)

Risk Characterization

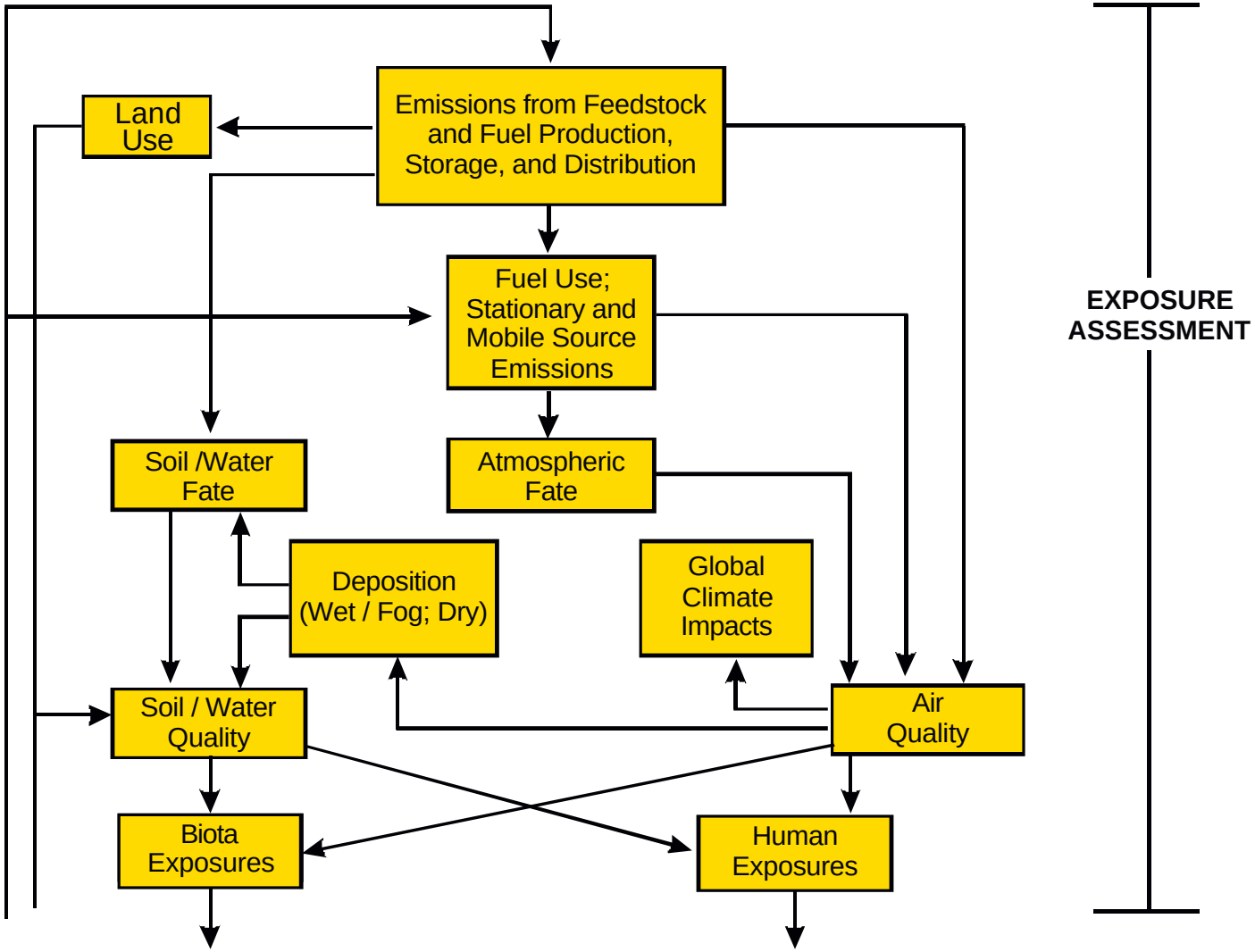
(Incidence of adverse effect)


Emissions Characterization:
Feedstocks, Fuel Production, Distribution, Use
Environmental Fate:
Air/Water Quality
Exposures:
Humans/Biota
Health Effects
Ecosystem Effects
Scientific Assessment
Risk Reduction

LCA / Risk Assessment Framework



LCA / R.A. Framework: Exposure Component



Some Possible Fuel Options for Comparative Assessment

- RFG/MTBE
- RFG/Ethanol
- RFG/nonOxygenate
- NOTE: These fuel options and the specific issues identified on the following pages are for illustrative purposes. They do not represent a judgment that these are necessarily the only options or the most important issues for consideration.

Source/Emissions Characterization

	RFG with:		
	MTBE	**EtOH**	**No Oxy**
Feedstock	Methane	Pesticides	Ref. Pt.?
Production	-- VOCs, GHGs --		”
Distribution	Small/chronic	Large/acute	”
Storage	-- Materials compatibility --		”

Source/Emissions Characterization (cont.)

	RFG with:		
	MTBE	**EtOH**	**No Oxy**
Use (evap. & combust.)	Air toxics, NOx, CO, etc.	CH_3CHO, alkylates, etc.	Alkylates, toluene, ??

Environmental Fate

	RFG with:		
	MTBE	**EtOH**	**No Oxy**
Air	HCHO, TBF	PAN	?
Subsurface	TBA	BTEX incrs.?	Alkylates
Surface Water	?	?	?

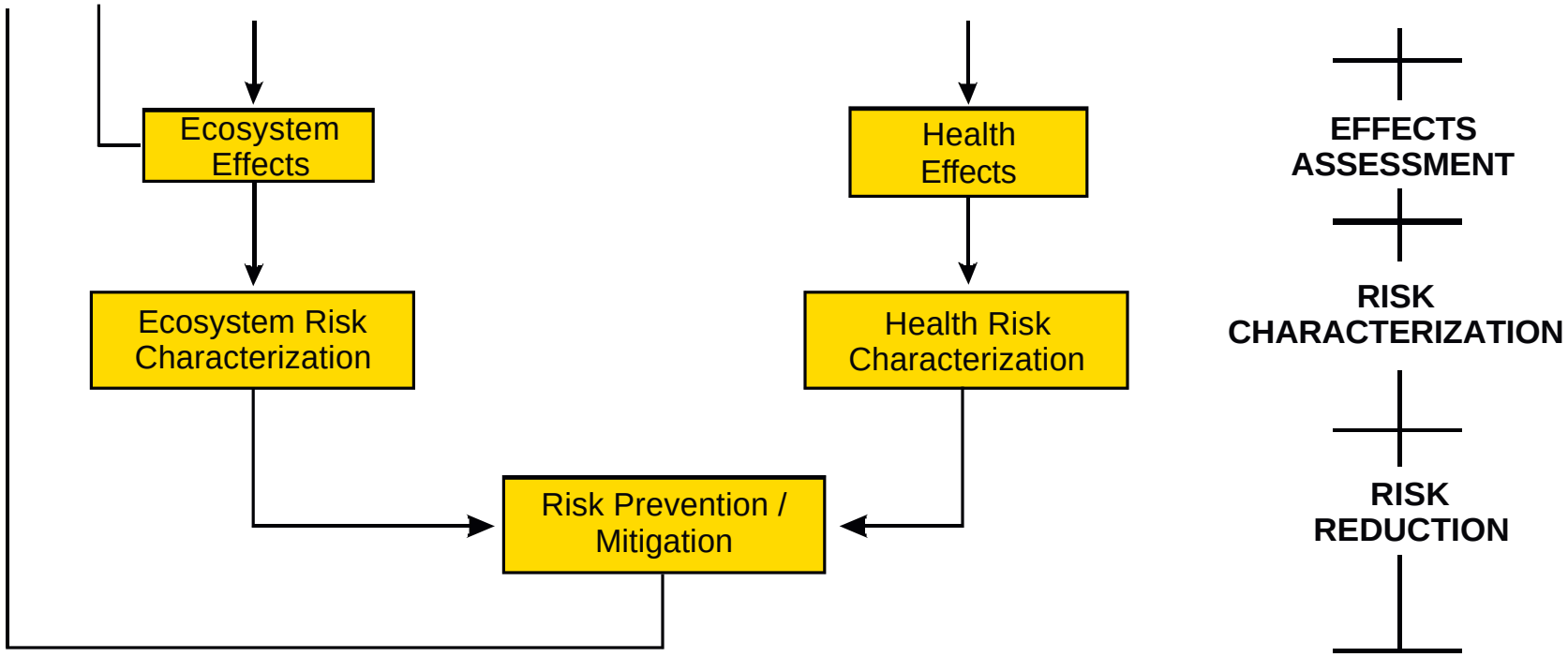
Environmental Quality

	RFG with:		
	MTBE	**EtOH**	**No Oxy**
Air	--	Air toxics, CO, O_3, GHGs	--
Subsurface	MTBE	EtOH, BTEX, alkylates	Alkylates
Surface Water	”	”	”

Exposure Assessment

	RFG with:		
	MTBE	**EtOH**	**No Oxy**
Human	--- Acute/Chronic ---		
	-- Personal & Population Exposures --		
	--- Cumulative & Mixtures ---		
Biota	--- Acute/Chronic ---		
	--- Aquatic/Terrestrial ---		

LCA / R.A. Framework: Cont'd.



Risk Assessment

Hazard Identification
(Qualitative)

Dose-Response
(Quantitative)

Exposure
(Population contact)

Risk Characterization

(Incidence of adverse effect)

Health Effects

	RFG with:		
	MTBE	**EtOH**	**No Oxy**
Acute	Neurobehavioral, Respiratory, Organoleptic, etc.?		
Chronic	Cancer Potency Inhalation RfC Oral RfD		

Ecosystem Effects

	RFG with:		
	MTBE	**EtOH**	**No Oxy**
Terrestrial	--	Organism	--
Aquatic	--	Population	--
Freshwater	--	Community/Ecosystem	--
Marine			

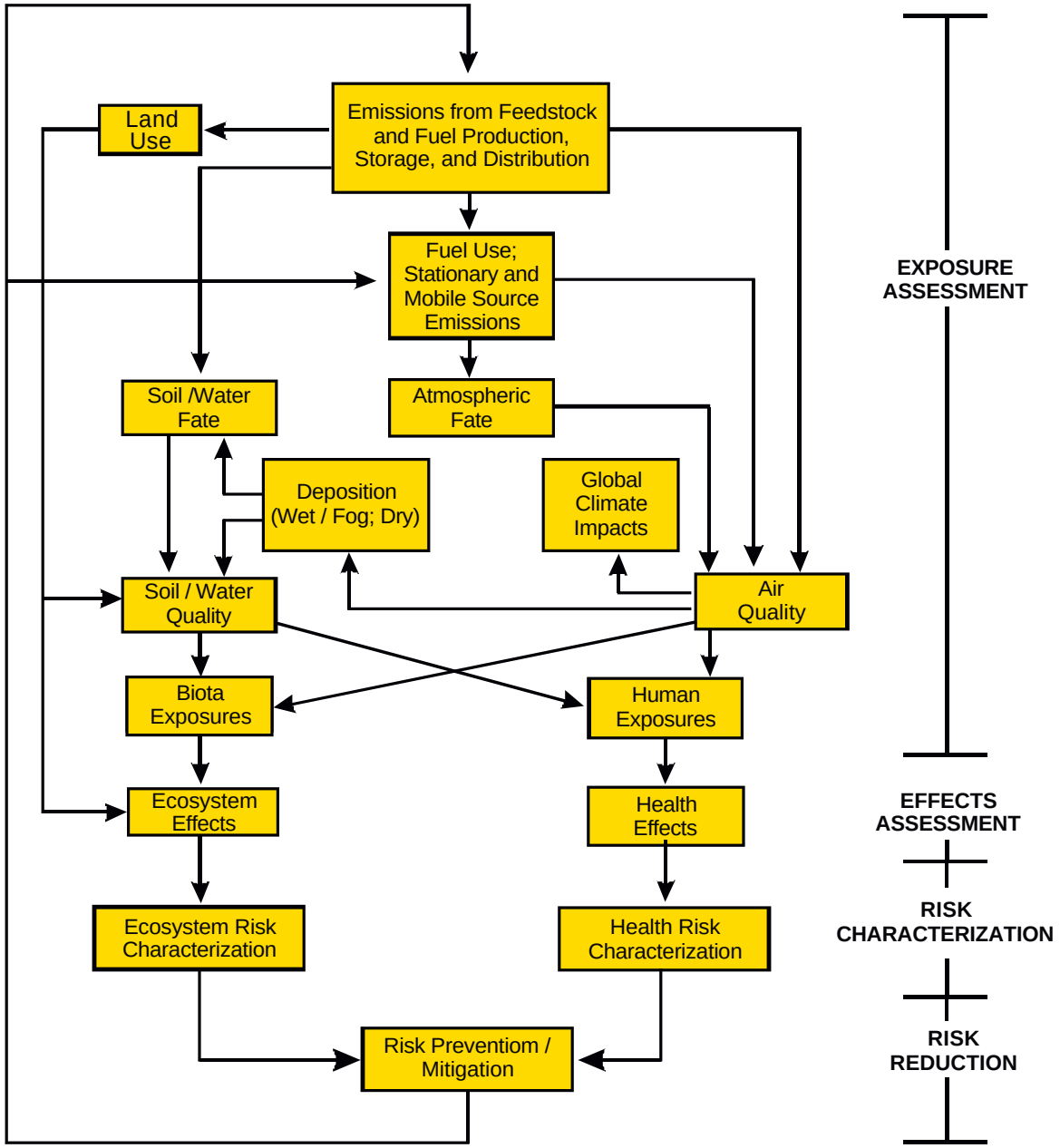
Global Climate Change

	RFG with:		
	MTBE	**EtOH**	**No Oxy**
CO_2			
Methane	Increases?		
N_20		Decreases?	
CO			
NOx			No Net Change?
VOCs			

Risk Characterization

		RFG with:	
	MTBE	**EtOH**	**No Oxy**
Human Health	Increased / decreased risks?	Increased / decreased risks?	Increased / decreased risks?
Ecosystem Impacts	”	”	”

LCA / Risk Assessment Framework



Risk Management

- Risk assessment feeds into risk management
- Risk management feeds back, e.g., emission controls may reduce exposure and hence risk
- LCA “sensitivity” analysis may identify critical points in life cycle where risk management efforts can be focused